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**Hsieh**

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(54) **DIRECT TYPE BACKLIGHT UNIT**

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(51) **Int. Cl.**
***F21V 7/04*** (2006.01)

(52) **U.S. Cl.** ..... **362/633**; 362/382; 362/632; 362/561

(58) **Field of Classification Search** ..... 362/382, 362/23, 632, 633, 634, 559, 561, 614, 603
See application file for complete search history.

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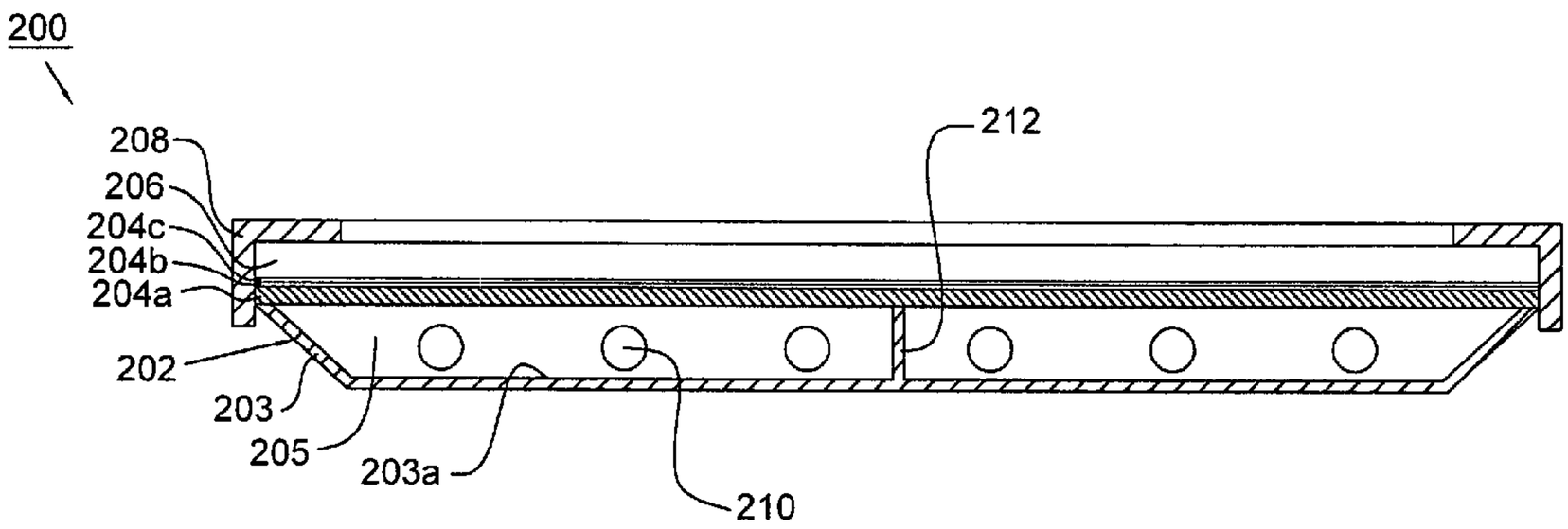
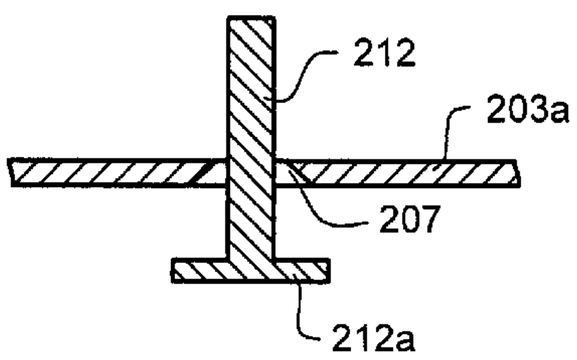
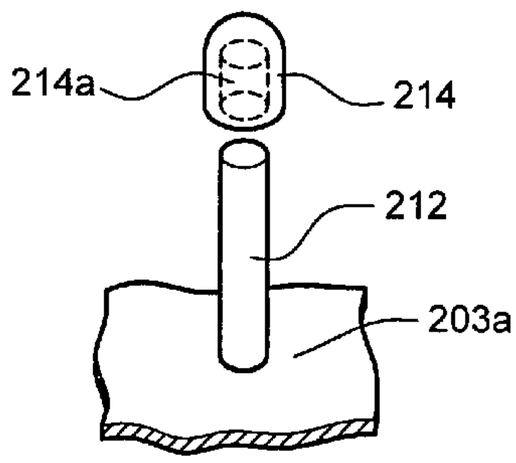
(57) **ABSTRACT**

A direct type backlight unit includes a metal housing having a base, at least one metal supporting pin and a buffer element. The metal supporting pin is formed integrally on the base and protrudes upwardly therefrom for supporting an optical film disposed upon the backlight unit, and the buffer element is disposed between the metal supporting pin and the optical film so as to prevent the metal supporting pin from damaging the optical film.

**14 Claims, 5 Drawing Sheets**



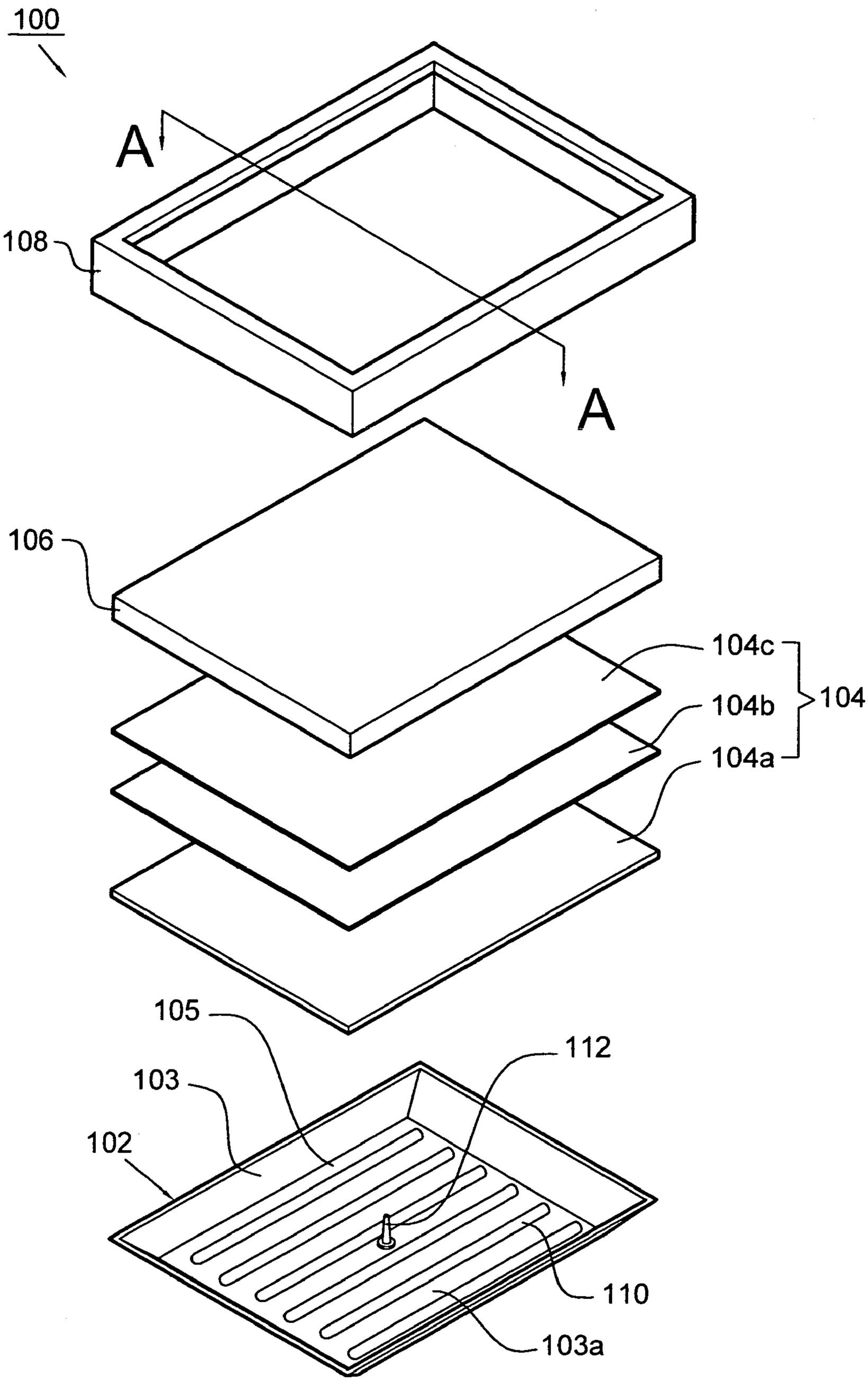



FIG. 1 (PRIOR ART)

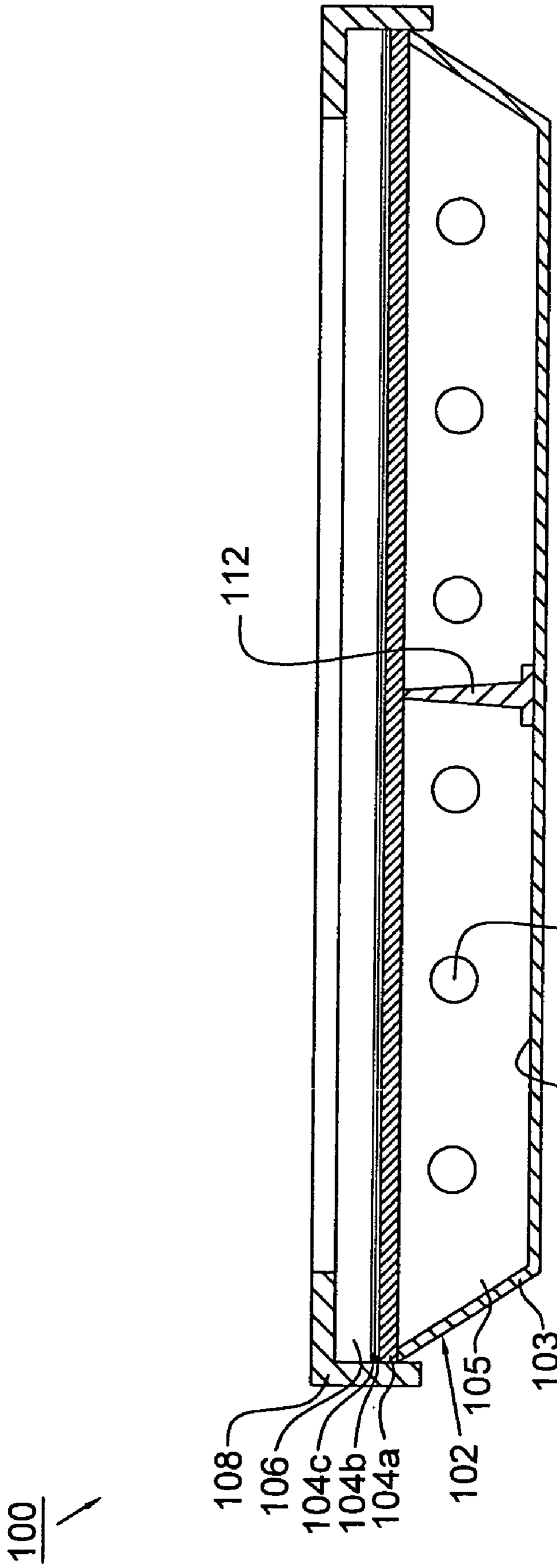



FIG. 2 (PRIOR ART)

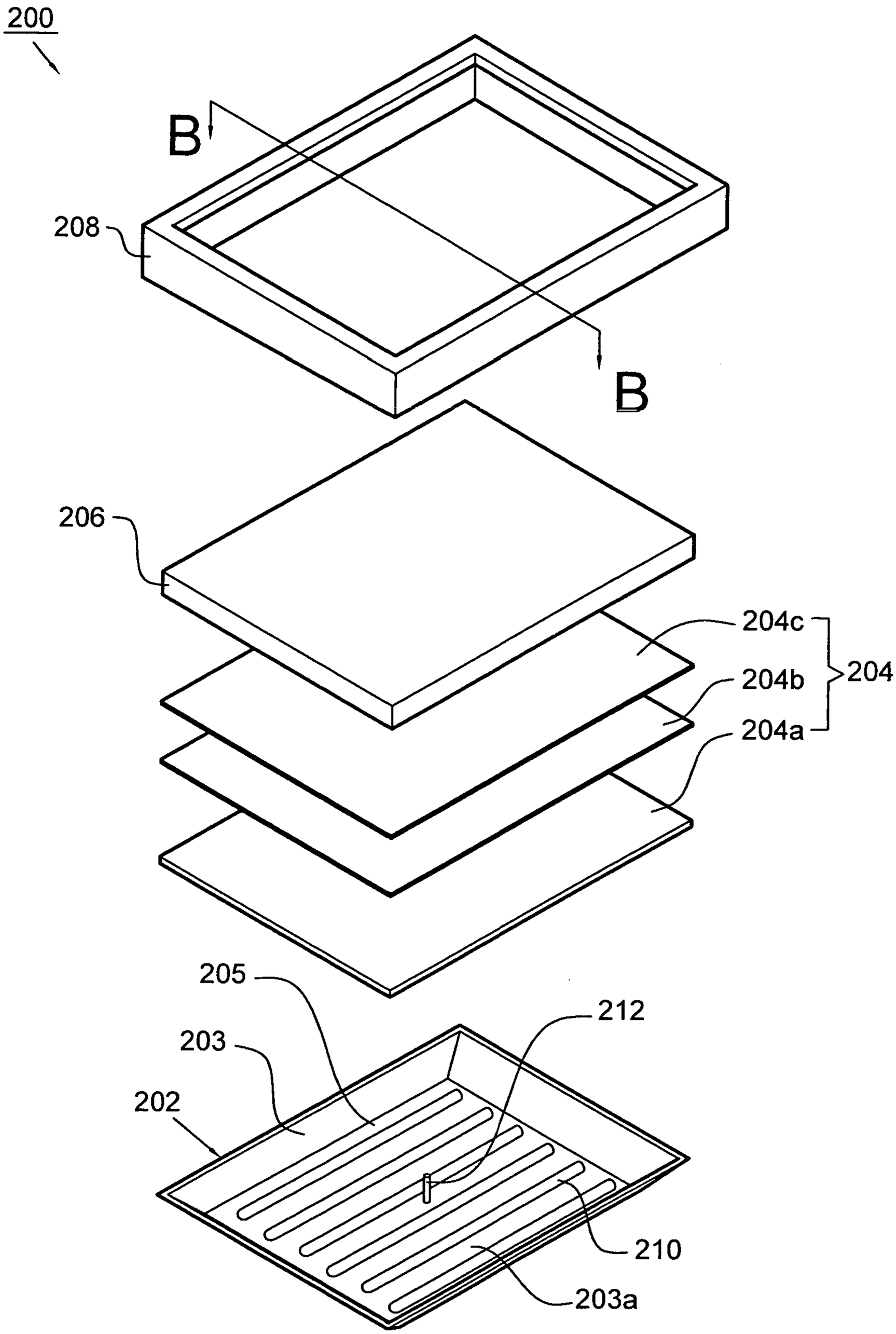



FIG. 3

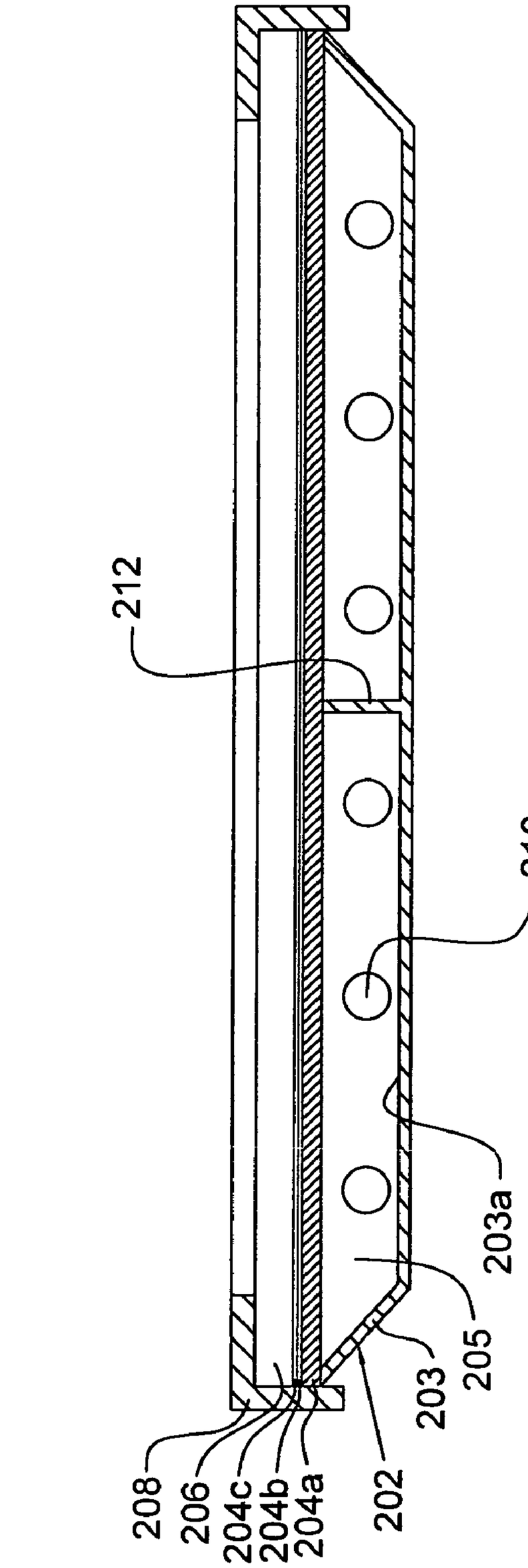



FIG. 4

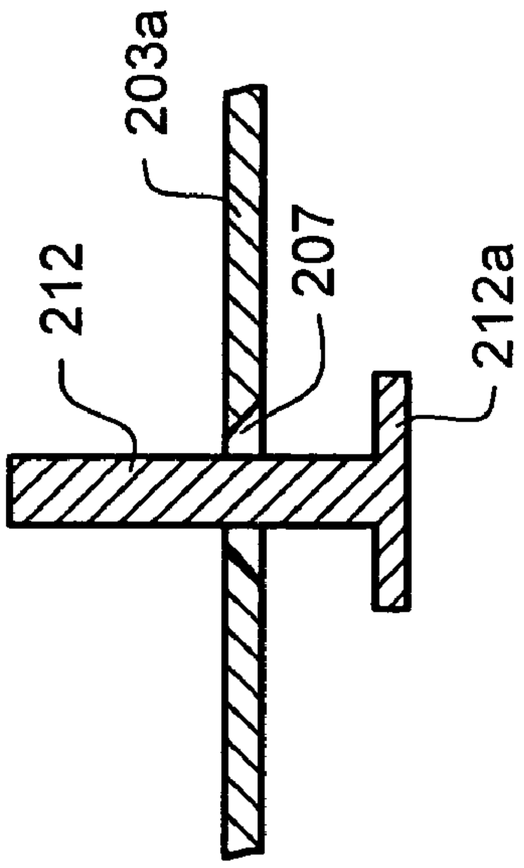



FIG. 5b

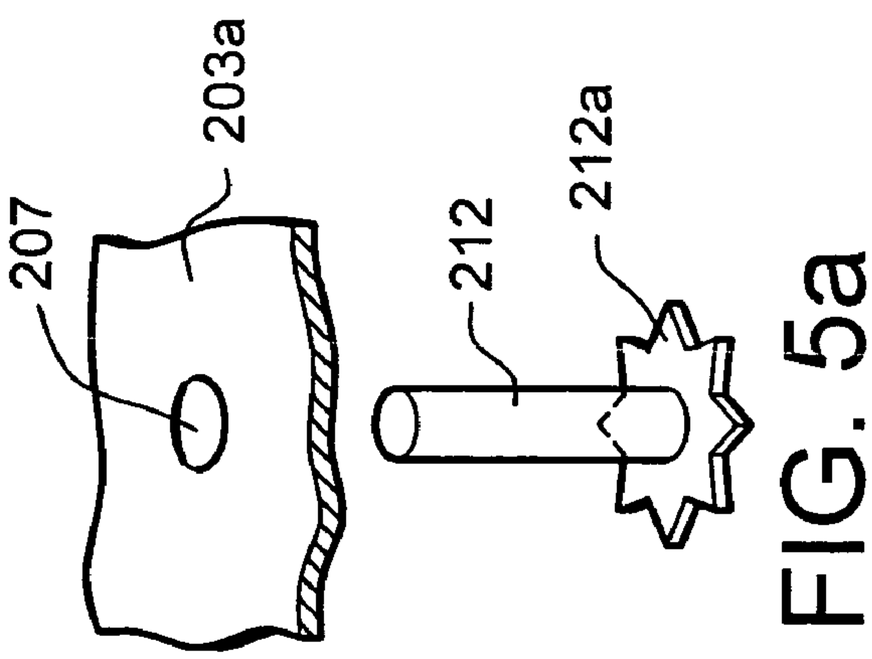



FIG. 5a

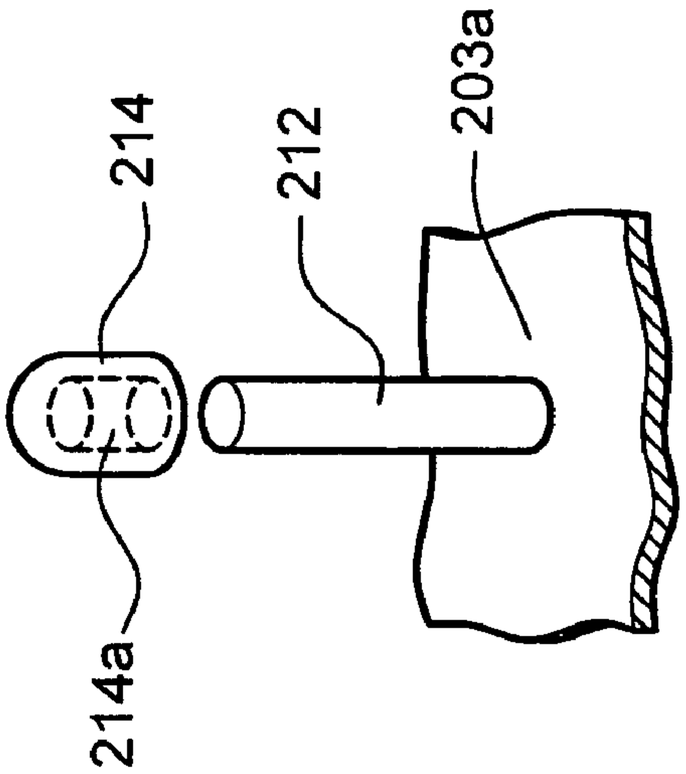

214
212
203a
214a

FIG. 6

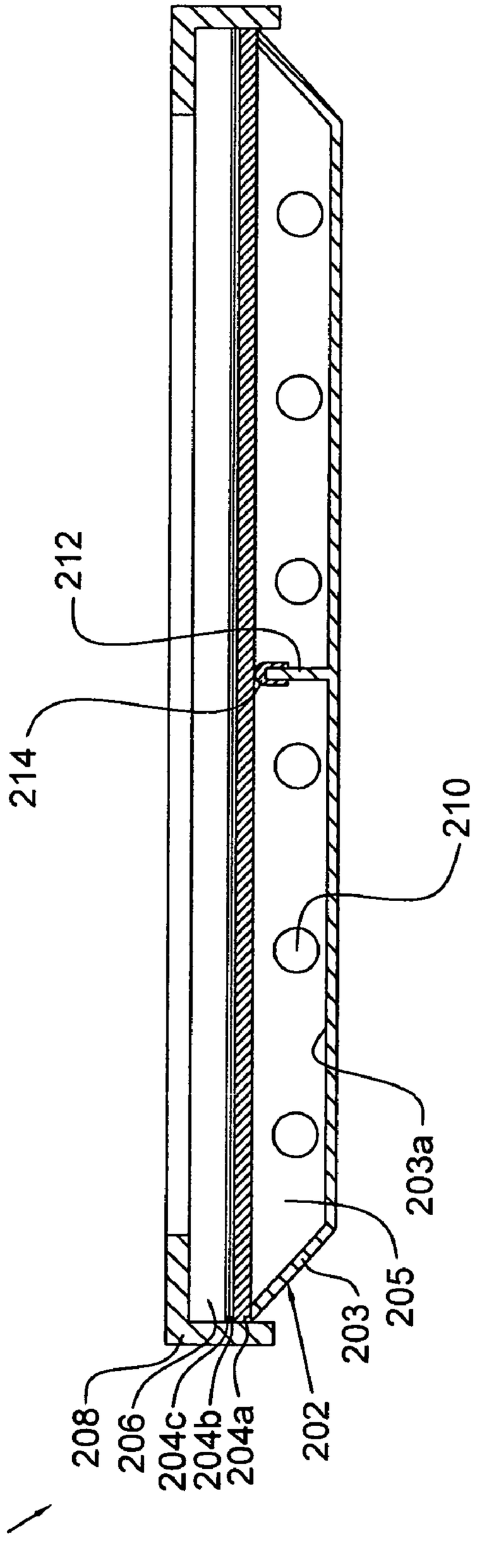

212
214
210
203a
205
203
202
208
206
204c
204b
204a
200

FIG. 7

# DIRECT TYPE BACKLIGHT UNIT

## RELATED APPLICATIONS

The present application is based on, and claims priority from, Taiwanese Application Serial Number 093100280, filed Jan. 6, 2004, the disclosure of which is hereby incorporated by reference herein in its entirety.

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention generally relates to a direct type backlight unit, and more particularly to a direct type backlight unit having a supporting pin formed integrally therein.

2. Description of the Related Art

Due to the advance of electronic technology, especially for the popularity of portable electronic products, the requirements of light, compact and low-energy consuming display are gradually increasing. With the advantages of low-energy consuming, low-heat dissipation, light weight and non-luminescence, liquid crystal displays (LCD) have been widely used in the electronic products and even have replaced the traditional CRT displays.

In general, a liquid crystal display usually comprises a backlight unit for providing light to its liquid crystal panel. However, the liquid crystal display may use different kinds of backlight units depending on its use and size. These backlight units mainly include two types, i.e. a direct back light type (or direct type) and an edge light type. The present invention herein is related to the direct type backlight unit, and thus only the direct type backlight unit will be described in following descriptions.

Referring to FIG. **1**, it shows an exploded schematic view of a liquid crystal display **100** having a direct type backlight unit in the prior art. The liquid crystal display **100** includes a backlight unit **102**, a set of optical films **104**, a liquid crystal panel **106** and a frame **108**. The backlight unit **102** is disposed under the liquid crystal panel **106** for distributing the light from a light source uniformly over the surface of the liquid crystal panel **106**. The backlight unit **102** comprises a metal housing **103** and lamps **100**, such as cold cathode fluorescent lamps (CCFL), disposed at the base of the metal housing **103**. The set of optical films **104** is disposed between the backlight unit **102** and the liquid crystal panel **106** and includes a diffuser **104***a* disposed upon the backlight unit **102** and a plurality of optical sheets, such as a diffusing sheet **140***b* and a prism sheet **140***c*, disposed on the diffuser **104***a*. The frame **108** is disposed upon the liquid crystal panel **106** and the set of optical films **104** and connected to the backlight unit **102** so as to fix the liquid crystal panel **106** and the set of optical films **104** on the backlight unit **102**. FIG. **2** shows a cross-sectional view of the assembled liquid crystal display **100** taken along line A—A in FIG. **1**.

The lamps **110** are spacedly disposed on the cavity **105** formed by the metal housing **103** and positioned under the display area of the liquid crystal panel **106** so as to distribute the light uniformly over the surface of the liquid crystal panel **106**. Further, since the lamps **110** need to keep a certain distance from the diffuser **104***a*, at least one supporting pin **112** is required to be disposed on the base **103***a* of the metal housing **103** for supporting the diffuser **104***a* such that the lamps **110** can keep a fixed distance from the diffuser **104***a*.

In the prior art, the supporting pin **112** is a white or transparent conical pin, which is typically made of polycarbonate (PC) or PMMA by the injection molding process. In addition, the base **103***a* of the metal housing **103** is covered with an adhesive film (not shown), and the supporting pin **112** adheres to the base **103***a* of the metal housing **103** by the adhesive film.



However, the reliability of such an adhesion manner to fix the supporting pin **112** on the base **103***a* of the metal housing **103** is usually poor.

Accordingly, the present invention provides a direct type backlight unit having a supporting pin formed integrally therein so as to solve the reliability problem of the supporting pin.

## SUMMARY OF THE INVENTION

It is an object of the present invention to provide a direct type backlight unit having a supporting pin formed integrally therein so as to solve the reliability problem of the supporting pin.

It is another object of the present invention to provide a direct type backlight unit having a supporting pin formed integrally therein wherein the supporting pin has a buffer element disposed thereon so as to prevent itself from damaging an optical film.

In order to achieve the above objects, the present invention provides a direct type backlight unit comprising a metal housing, at least one metal supporting pin and a buffer element. The metal supporting pin is formed integrally on a base of the metal housing and protrudes upwardly from the base for supporting an optical film disposed upon the backlight unit, and the buffer element is disposed between the metal supporting pin and the optical film so as to prevent the metal supporting pin from damaging the optical film.

According to the direct type backlight unit of the present invention, the metal supporting pin is formed integrally on the base of the metal housing by the press forming process so as to solve the reliability problem of the supporting pin. Further, the buffer element is preferably a white buffer cap and caps on the metal supporting pin so as to prevent the metal supporting pin from damaging the optical film.

## BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, advantages, and novel features of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

FIG. **1** is an exploded schematic view of a liquid crystal display having a direct type backlight unit in the prior art.

FIG. **2** is a cross-sectional view of the assembled liquid crystal display taken along line A—A in FIG. **1**.

FIG. **3** is an exploded schematic view of a liquid crystal display according to one embodiment of the present invention.

FIG. **4** is a cross-sectional view of the assembled liquid crystal display taken along line B—B in FIG. **3**.

FIGS. **5***a* and **5***b* are respectively an enlarged perspective view and an enlarged cross-sectional view for illustrating how the metal supporting pin is to be formed on the metal base.

FIG. **6** is a schematic view of the combined structure of a buffer cap and the metal pin.

FIG. **7** is a cross-sectional view of a liquid crystal display according to another embodiment of the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **3** is an exploded schematic view of a liquid crystal display **200** according to one embodiment of the present invention. The liquid crystal display **200** comprises a liquid crystal panel **206** for producing an image and a direct type backlight unit **202** for emitting light to the liquid crystal panel **206**. A set of optical films **204** is disposed between the backlight unit **202** and the liquid crystal panel **206**. The set of optical films **204** includes a diffuser **204***a* disposed upon the backlight unit **202** and a plurality of optical sheets, such as a diffusing sheet **204***b* and a prism sheet **204***c*, disposed on the diffuser **204***a*. The diffuser **204***a* is disposed upon the backlight unit **202** and typically made of half-transparent polyethylene terephthalate (PET), polyethylene terephthalate, or polycarbonate for further evenly diffusing the light emitted from the backlight unit **202**. Then, the diffused light will pass through the plurality of optical sheet, such as the diffusing sheet **204***b* and the prism sheet **204***c*, and finally reach the liquid crystal panel **206**. A frame **208** is disposed upon the liquid crystal panel **206** for fixing the liquid crystal panel **206** and the set of optical films **204** upon the backlight unit **202**.

Now referring to FIG. **4**, it is a cross-sectional view of the assembled liquid crystal display taken along line B—B in FIG. **3**. The backlight unit **202** comprises a metal housing **203**, which defines a cavity **205** for accommodating a plurality of lamps **210** such as cold cathode fluorescent lamps (CCFL). The lamps **210** are spacedly disposed on the cavity **205** and positioned under the set of optical films **204**, so as to emit light to the set of optical films **204** and then distribute it uniformly over the surface of the liquid crystal panel **206** while the light passes through the set of optical films **204**.

The metal housing **203** includes a metal base **203***a* having a metal supporting pin **212** disposed thereon and protruding upwardly therefrom for supporting the diffuser **204***a*. The metal supporting pin **212** is formed integrally on the metal base **203***a* so as to form a firmly fixed structure, and therefore provided with higher reliability.

FIGS. **5***a* and **5***b* are respectively an enlarged perspective view and an enlarged cross-sectional view for illustrating how the metal supporting pin is to be formed on the metal base. The supporting pin **212** is a cylindrical metal pin with a polygonal base **212***a* and the metal base **203***a* has a hole **207** before the metal supporting pin **212** is formed integrally on the metal base **203***a*. Preferably, the diameter of the cylindrical metal pin is about 1.0 mm to 1.5 mm. The hole **207** tapers off from the bottom surface toward the top surface of the metal base **203***a* (as shown in **5***b*), and the cylindrical metal pin **212** is to be inserted into the hole **207** from the bottom surface and then formed integrally on the metal base **203***a* by the press forming process.

The metal supporting pin **212** according to the present invention preferably has a buffer element disposed on its top so as to prevent itself from damaging the diffuser **204***a*. The buffer element is preferably made of a material of which the hardness is lower than that of the diffuser **204***a*.

FIG. **6** is a schematic view of the combined structure of a buffer cap **214** and the metal supporting pin **212**. The buffer element can be made into the buffer cap **214** shown in FIG. **6**, and the buffer cap **214** is preferably white and made of silicon rubber. The buffer cap **214** is a cap having a domelike top and defines a combination hole **214***a* for capping the top of the metal supporting pin **212**. FIG. **7** is a cross-sectional view of a liquid crystal display **200** according to another embodiment of the present invention. The top of the metal supporting pin **212** is capped with the buffer cap **214** shown in FIG. **6**, such that the metal supporting pin **212** is prevented from directly contacting the diffuser **204***a* and thus can be prevented from damaging the diffuser **204***a* by such a manner.



It should be noted that the presently disclosed embodiments are to be considered in all respects as illustrative and not restrictive. For example, there can be a plurality of metal supporting pins **212** to be evenly formed on the metal base **203***a* such that each lamp **210** can keep a fixed distance from the diffuser **104***a*. In addition, the metal supporting pin **212** can be formed in any shapes (such as conical shape) and therefore should not be limited to the cylindrical shape as illustrated in above embodiments of the present invention.

According to the direct type backlight unit of the present invention, the metal supporting pin for supporting the diffuser is formed integrally on the metal housing of the direct type backlight unit by the press forming process so as to solve the conventional reliability problem of the supporting pin. Further, the metal supporting pin has a buffer element, which is preferably a white buffer cap, disposed thereon so as to prevent the metal supporting pin from damaging the optical film supported thereby.

In addition, one feature of the present invention is that a supporting pin for supporting an optical film is formed integrally on the housing of a backlight unit and has a buffer element disposed thereon so as to prevent itself from damaging the supported optical film. Therefore, it should be understood that the material of the supporting pin and the housing of the backlight unit in the embodiment of the present invention are not limited to metal, and the uses of other materials such as plastic, resin or some hardened substances are also falling into the scope of the present invention.

Although the invention has been explained in relation to its preferred embodiment, it is not used to limit the invention. It is to be understood that many other possible modifications and variations can be made by those skilled in the art without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

**1**. A direct type backlight unit, comprising:

a housing having a base and side walls extending upwardly from a peripheral region of said base, said base and said side walls together defining a cavity;

at least a lamp disposed in said cavity;

an optical film disposed on top of the side walls of said housing; and

at least on supporting pin protruding upwardly from a middle region the base and supporting the optical film from below;

wherein

said base has a through hole in the middle region thereof, said through hole having opposite upper and lower openings, and the upper opening being smaller that the lower opening;

said supporting pin includes a post member sized to be passable through the upper opening of the through hole, and a base member connected to a lower end of said post member and sized to be not passable through said upper opening;

said base member is received in the through hole thereby fixing said supporting pin to said base;

said post member extends upwardly from said base member through said upper opening into cavity of said

housing and terminates at an upper end on which the optical film is supported; and

said backlight unit further comprises a buffer element being disposed between the upper end of the post member and the optical film and preventing direct physical contact between the upper end of the post member and the optical film.

**2**. The direct type backlight unit as claimed in claim **1**, wherein the housing and the supporting pin are made of metal.

**3**. The direct type backlight unit as claimed in claim **2**, wherein the supporting pin is formed integrally on the base of the housing by a press forming process.

**4**. The direct type backlight unit as claimed in claim **3**, wherein the press forming process is processed by inserting a metal supporting pin into a hole defined in the base of the housing so as to make the supporting pin formed integrally on the base of the housing.

**5**. The direct type backlight unit as claimed in claim **1**, wherein the housing and the supporting pin are made of plastic.

**6**. The direct type backlight unit as claimed in claim **1**, wherein the housing and the supporting pin are made of resin.



**7**. The direct type backlight unit as claimed in claim **1**, wherein the supporting pin is cylindrical in shape.

**8**. The direct type backlight unit as claimed in claim **1**, wherein the supporting pin is conical in shape.

**9**. The direct type backlight unit as claimed in claim **1**, wherein the buffer element is made of silicon rubber.

**10**. The direct type backlight unit as claimed in claim **1**, wherein the buffer element is a buffer cap configured to cap the top of the supporting pin.

**11**. The direct type backlight unit as claimed in claim **10**, wherein the buffer cap is made of silicon rubber.

**12**. The direct type backlight unit as claimed in claim **10**, wherein the buffer cap is white.

**13**. The direct type backlight unit as claimed in claim **1**, wherein the optical film is a diffuser.

**14**. The direct type backlight unit as claimed in claim **1**, wherein said buffer element is a cap having an inner space which receives therein the upper end of said post member; and

a material of said cap is different from a material of said post member and softer than a material of said optical film.

* * * * *